Cells and Heredity

7-2 The student will demonstrate an understanding of the structure and function of cells, cellular respiration, and heredity. (Life Science)

7-2.6 Use Punnett squares to predict inherited monohybrid traits.
Taxonomy level: 3.2-C Apply Procedural Knowledge

Previous/Future knowledge: Students have received no previous instruction in the use of Punnett squares. Students should have a beginning level of understanding of genetics and dominant and recessive genes.

It is essential for students to know that offspring inherit the genes for particular traits from their parents.

- Genes for a particular trait normally come in pairs.
- Since each parent normally has two alleles for a single trait, we use a Punnett square to determine the possibilities of the combinations of alleles that the offspring may receive.
- A *Punnett square* is a tool used to predict the ratio or percentage of the possible genes that an offspring will have based on the genes of the parent.

In a Punnett square, the top of the table shows the alleles provided by one parent.

- The alleles for the other parent are placed along the left side of the table.
- One allele from each parent is placed in the individual squares, forming a new gene pair.
- The individual squares show the possibilities of allele pairs in the offspring.
- For example, the following table shows the cross Tt x tt:

	t	t
T	Tt	Tt
t	tt	tt

- In this example, tallness (T) is the dominant trait and shortness (t) is the recessive trait.
- As the Punnett square shows, TT, Tt, and tt are all possible genotypes for the height of the offspring.
- The offspring with the genotypes TT and Tt will have a phenotype of tall; the offspring with the genotype of tt will have a phenotype of short.
- If the two alleles are the same (TT or tt), the genotype is considered *purebred*. If the two alleles are different (Tt), the genotype is considered *hybrid*.
- This example shows the inheritance of a single characteristic (height). A cross that shows the inheritance of a single characteristic is known as a *monohybrid cross*.
- It is sometimes difficult to predict certain traits in humans (for example hair color or eye color) because there may be several different genes that control these traits.

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It is not essential for students to know how to use Punnett squares to show incomplete dominance or multiple traits. Pedigree charts are also not essential.

Assessment Guidelines:
The objective of this indicator is to *use* Punnett squares to predict inherited monohybrid traits; therefore, the primary focus of assessment should be to apply procedural knowledge of a Punnett square to determine the possible inheritance of one trait. However, appropriate assessments should also require students to *interpret* some basic information on a Punnett square; *compare* allele combinations that would relate to different genetic predictions; or *predict* the ratio or probability of traits.